1/29

LUMBER TILT HOIST

SMOOTH TOP CHAIN WAY

SHEET FEEDER

PLANER

LINEAR ACCELERATION DEVICE

TRANSVERSE ACCELERATION DEVICE

PLANER INFEED TRANSPORT DEVICE

*Fig 1*

CONVENTIONAL PLANER INFEED SYSTEM

.060 Sec    .100 Sec    .150 Sec

WORK PIECE

NO GAP REQUIRED

PLANER

*Fig 2*

SIMPLIFIED EXAMPLE OF FULLY OPTIMIZED GAP CONTROL

**SUBSTITUTE SHEET (RULE 26)**

2/29

CONTROL SYSTEM

LUMBER TILT HOIST

SMOOTH TOP CHAIN WAY

SHEET FEEDER

VARIABLE SPEED OPTIMIZING PLANER

INDIVIDUAL VARIABLE SPEED DRIVES

LINEAR WORK PIECE INTERROGATOR

VARIABLE SPEED LINEAR ACCELERATION DEVICE

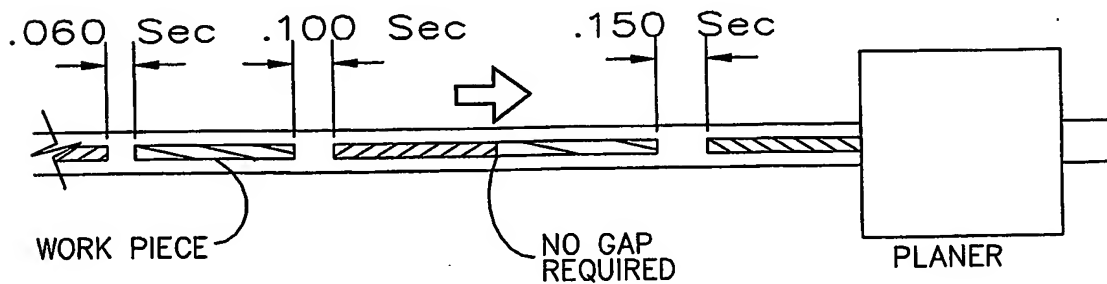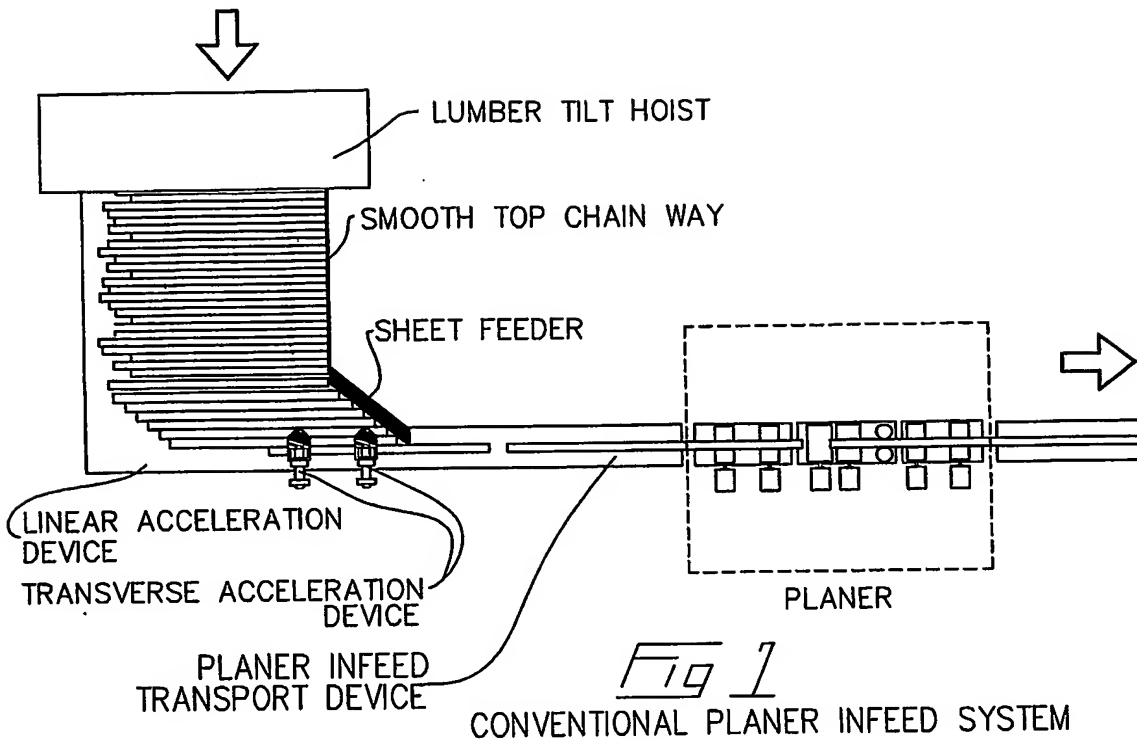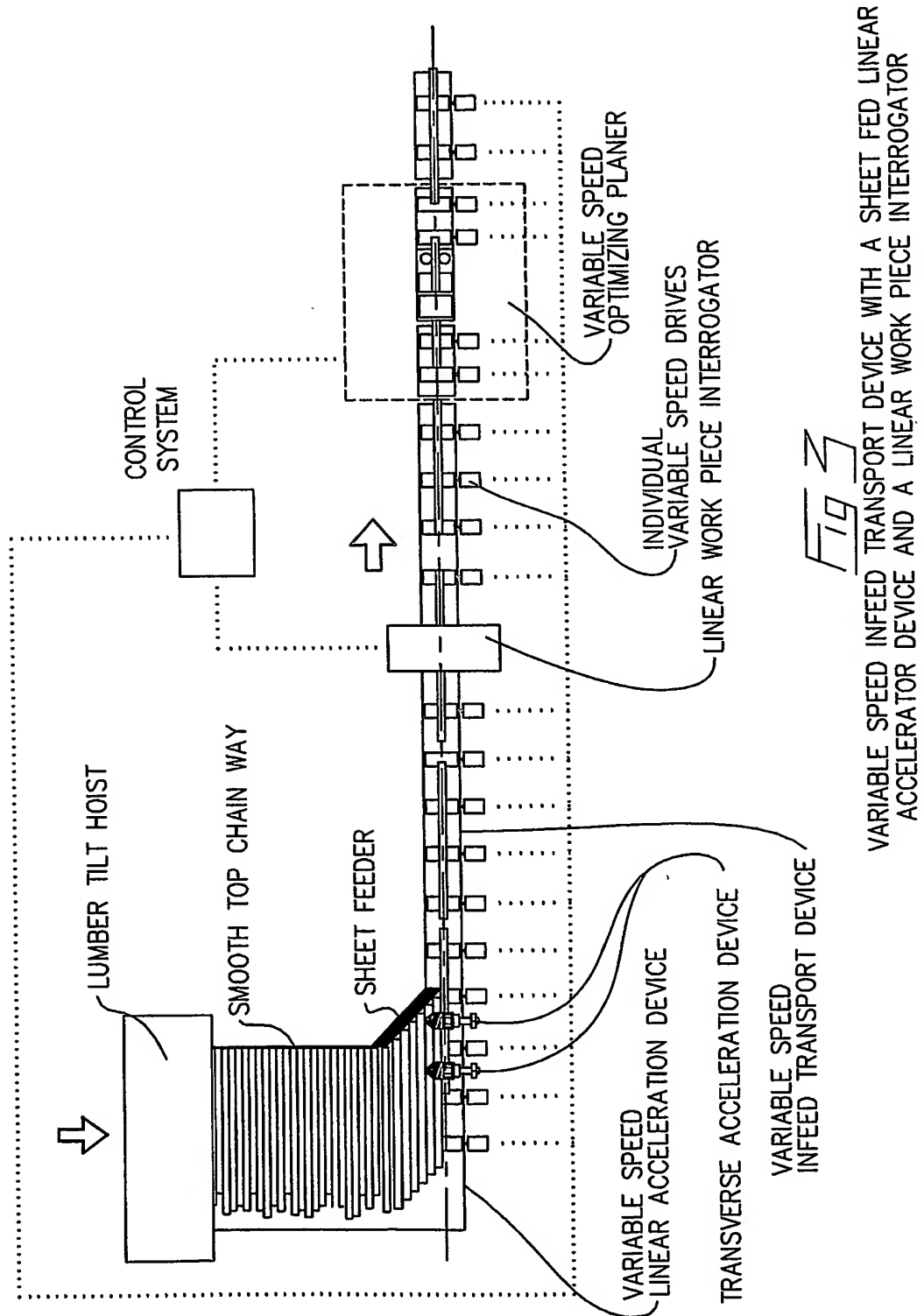TRANSVERSE ACCELERATION DEVICE

VARIABLE SPEED INFEED TRANSPORT DEVICE

*Fig 2*

VARIABLE SPEED INFEED TRANSPORT DEVICE WITH A SHEET FED LINEAR ACCELERATOR DEVICE AND A LINEAR WORK PIECE INTERROGATOR
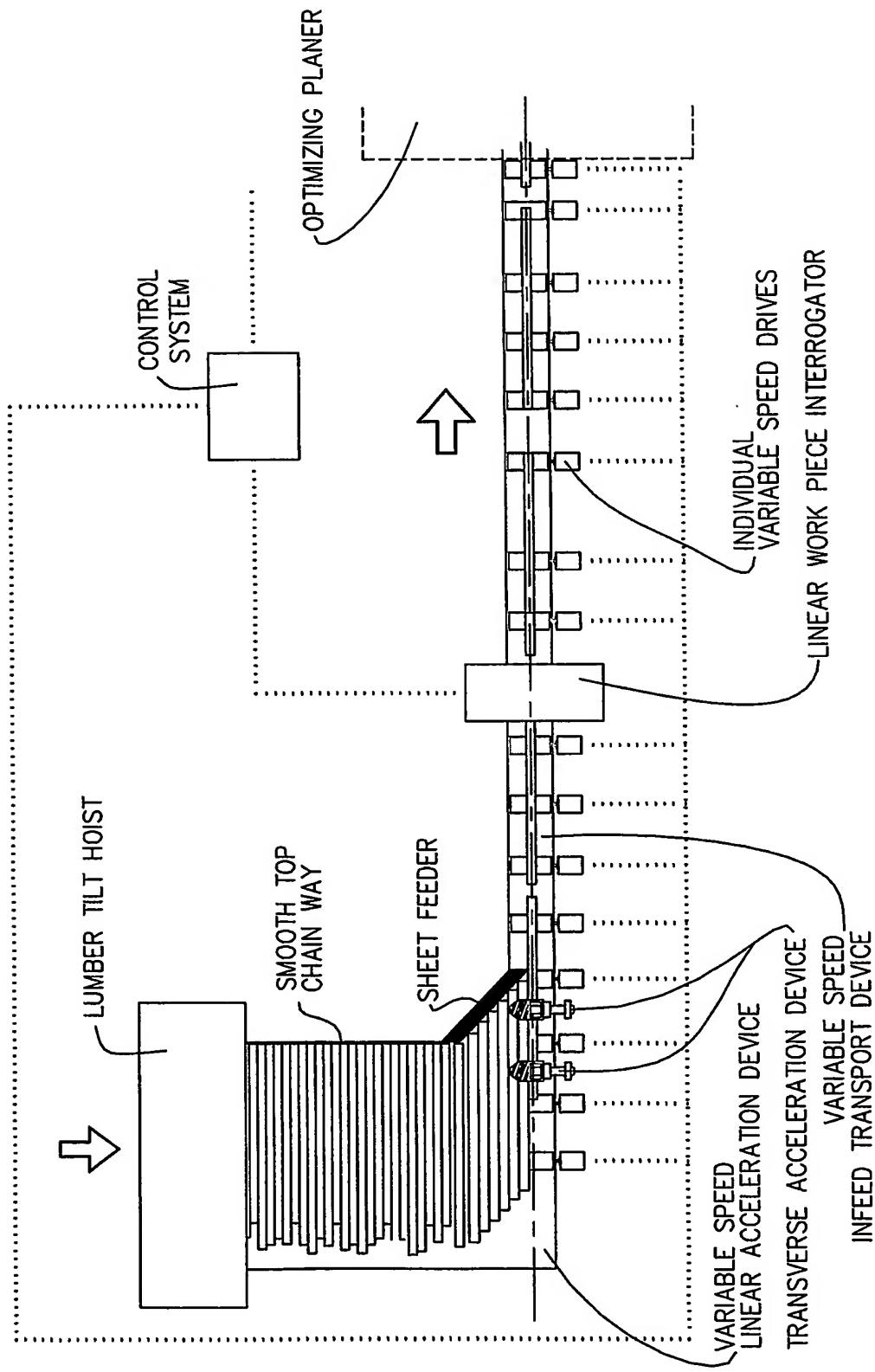
*Fig 4*

VARIABLE SPEED INFEED TRANSPORT DEVICE WITH A SHEET FED LINEAR
ACCELERATION DEVICE AND A LINEAR WORK PIECE INTERROGATOR
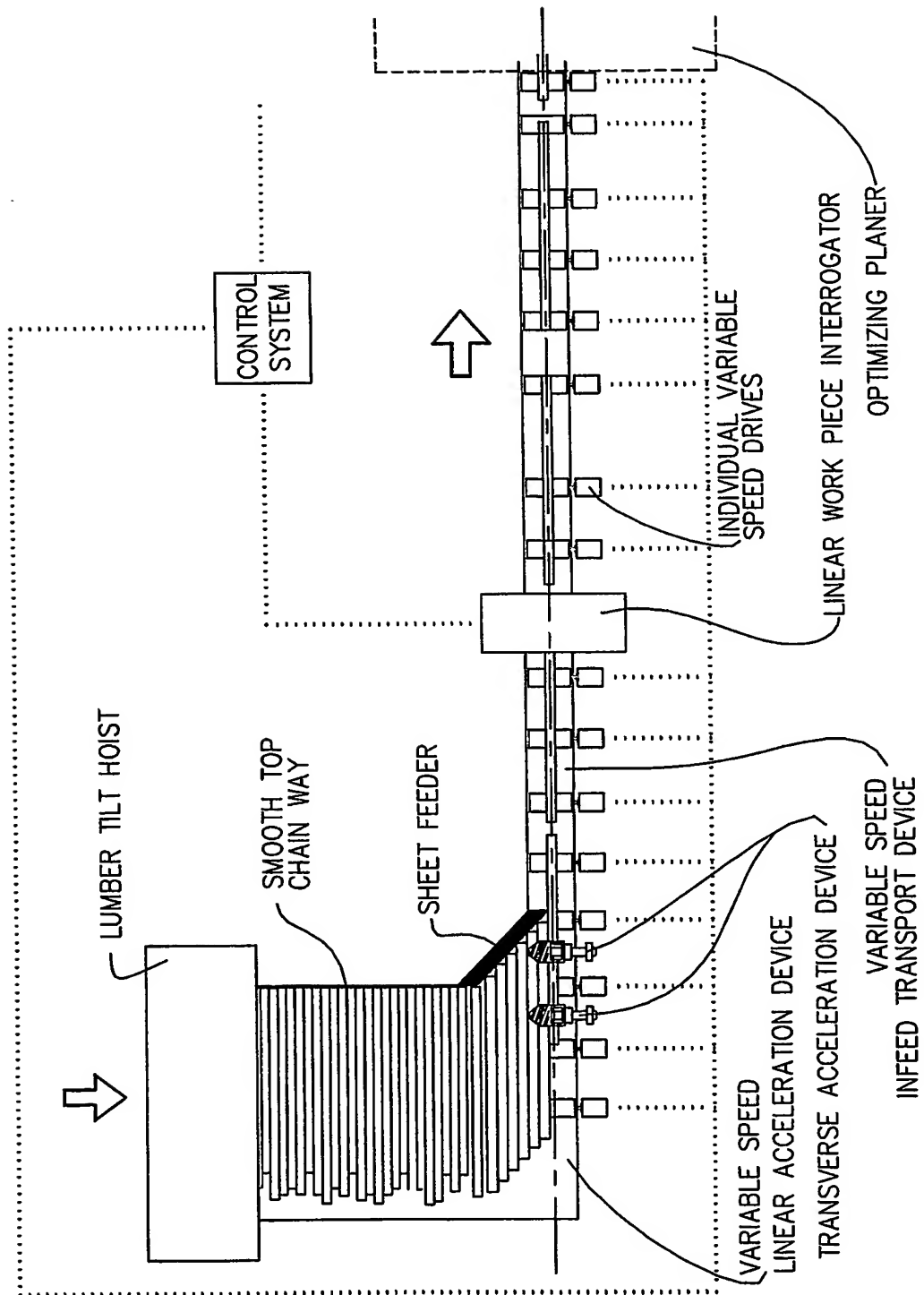(WITH CLOSED LOOP NON OPTIMIZING CONTROL)

4/29



LUMBER TILT HOIST

CONTROL SYSTEM

SMOOTH TOP CHAIN WAY

SHEET FEEDER

(INDIVIDUAL VARIABLE SPEED DRIVES)

LINEAR WORK PIECE INTERROGATOR

OPTIMIZING PLANER

VARIABLE SPEED LINEAR ACCELERATION DEVICE

TRANSVERSE ACCELERATION DEVICE

VARIABLE SPEED INFEED TRANSPORT DEVICE

*Fig 5*

VARIABLE SPEED INFEED TRANSPORT DEVICE WITH A SHEET FED LINEAR ACCELERATION DEVICE AND A LINEAR WORK PIECE INTERROGATOR (WITH CLOSED LOOP OPTIMIZING CONTROL)
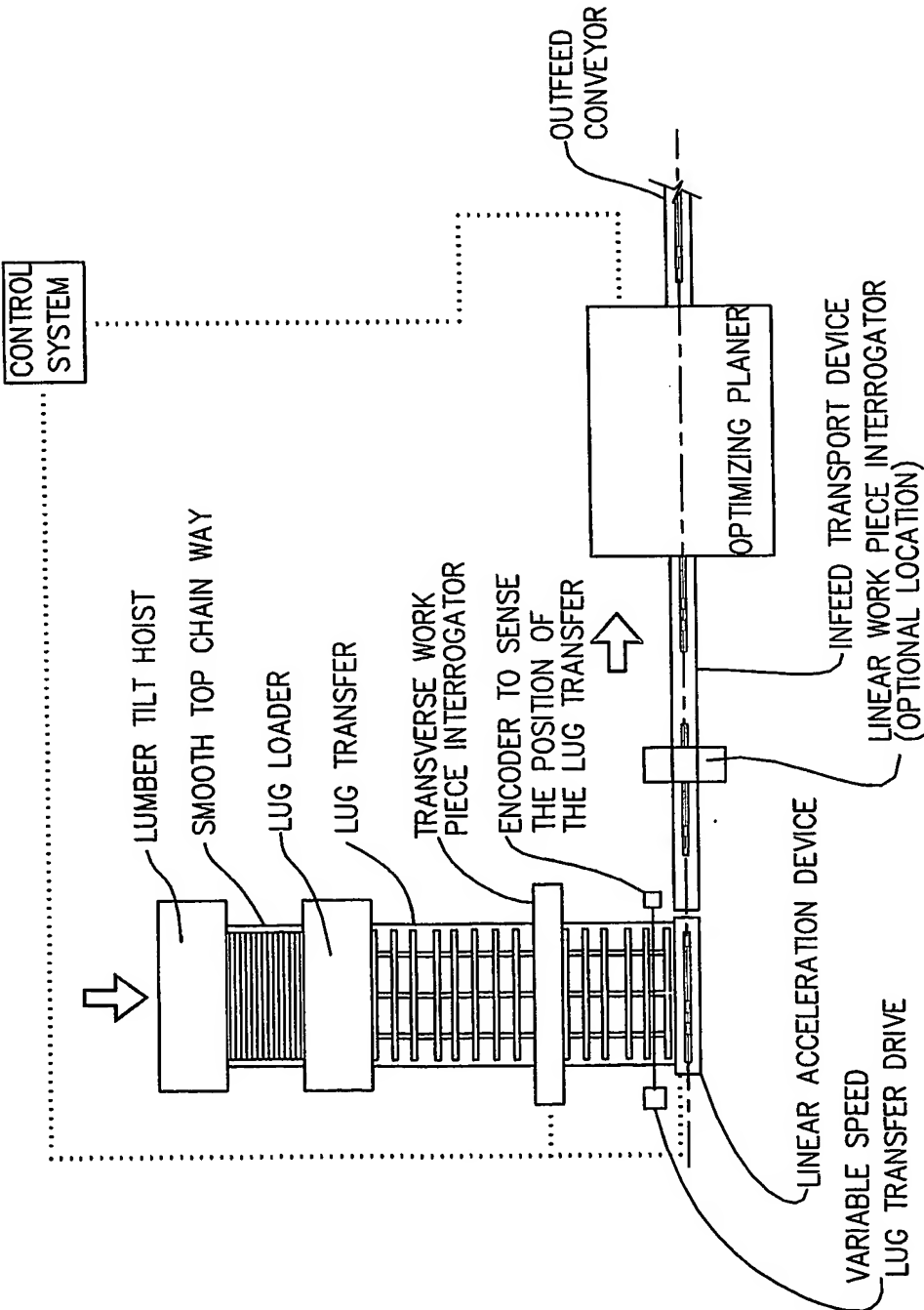
Fig 6

VARIABLE SPEED LUG TRANSFER WITH TRANSVERSE WORK PIECE INTERROGATOR
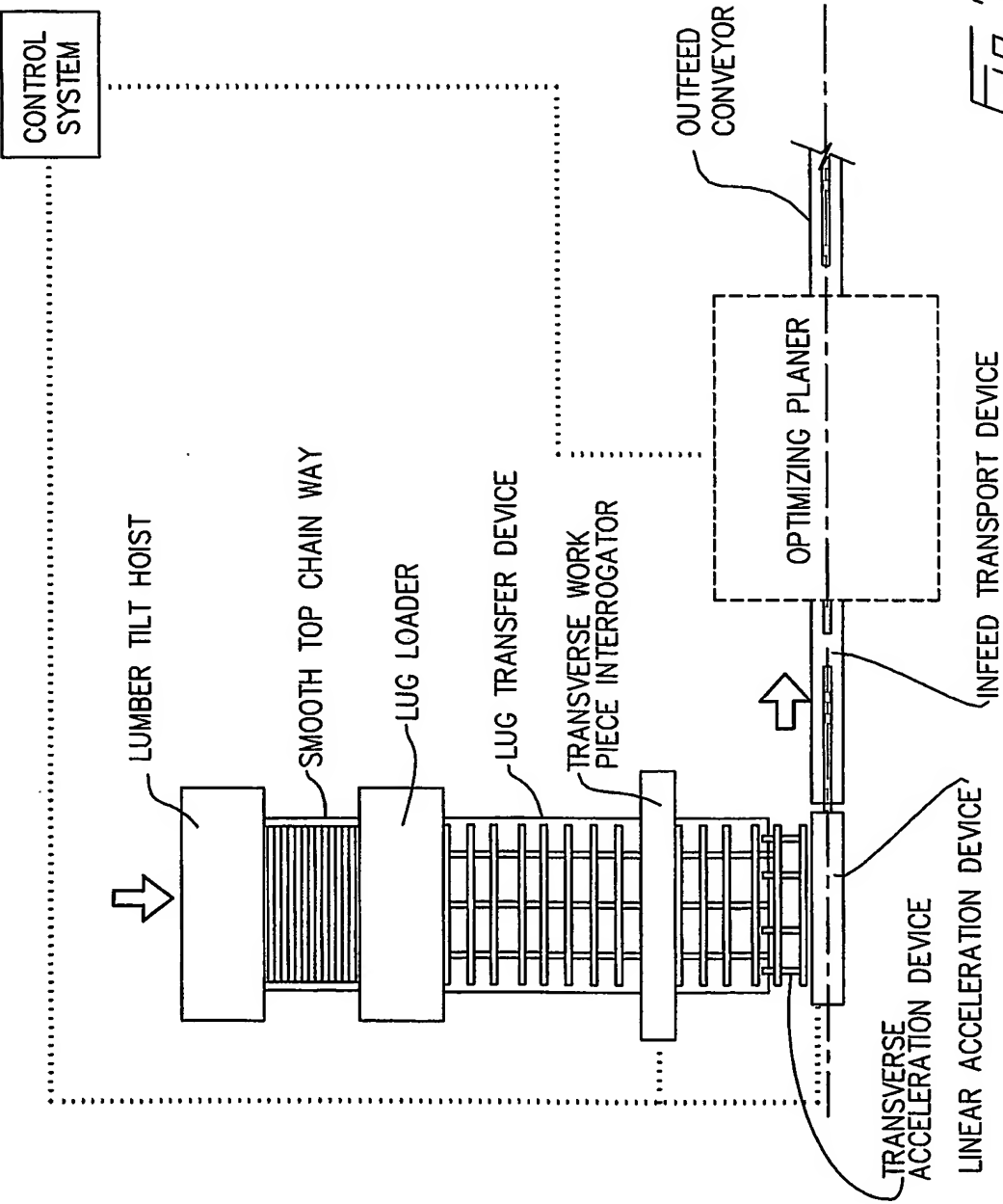(SHOWN WITH OPTIONAL LINEAR WORK PIECE INTERROGATOR)

CONTROL SYSTEM

LUMBER TILT HOIST

SMOOTH TOP CHAIN WAY

LUG LOADER

LUG TRANSFER DEVICE

TRANSVERSE WORK PIECE INTERROGATOR

TRANSVERSE ACCELERATION DEVICE

OPTIMIZING PLANER

OUTFEED CONVEYOR

INFEED TRANSPORT DEVICE

LINEAR ACCELERATION DEVICE

LUG TRANSFER DEVICE WITH TRANSVERSE ACCELERATION DEVICE

Fig 7

OPTIMIZING PLANER

CONTROL SYSTEM

LUMBER TILT HOIST

SMOOTH TOP CHAIN WAY

LUG LOADER

LUG TRANSFER DEVICE

TRANSVERSE WORK PIECE INTERROGATOR

SHEET FEEDER

INDIVIDUAL VARIABLE SPEED DRIVES

VARIABLE SPEED INFEED TRANSPORT DEVICE

VARIABLE SPEED LINEAR ACCELERATION DEVICE TRANSVERSE ACCELERATION DEVICE

*Fig 4*
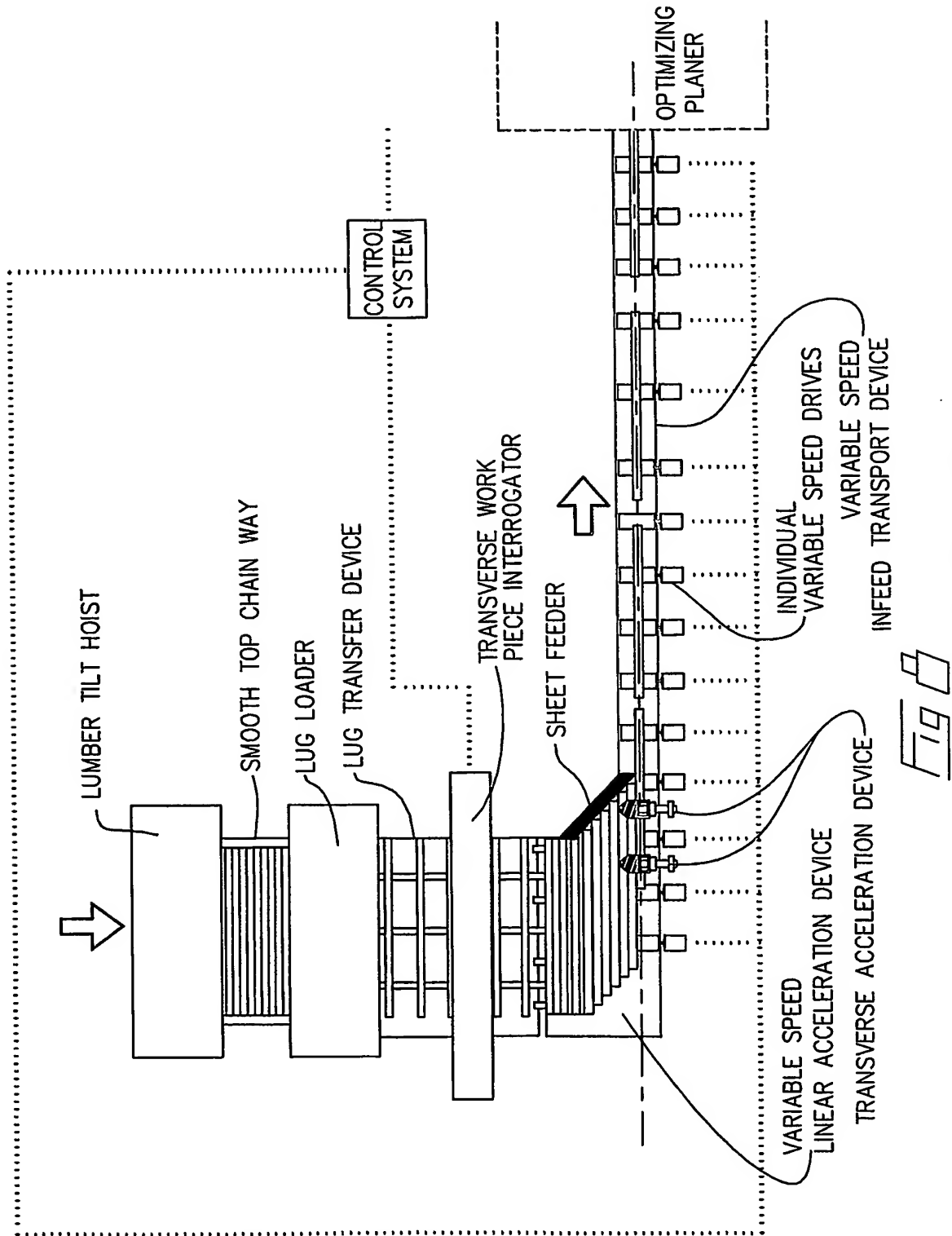
LUG TRANSFER DEVICE USED IN COMBINATION WITH A SHEET FED VARIABLE SPEED LINEAR ACCELERATION DEVICE

ACCELERATOR ROLLER

SECOND
WORKPIECE
WORKPIECE

LINEAR
ACCELERATION
DEVICE

LUG

FIRST WORK
PIECE

FLOW

FEED ROLLER

LUG CHAIN

LUG CHAIN
DRIVE SHAFT

LUG CHAIN RETURN
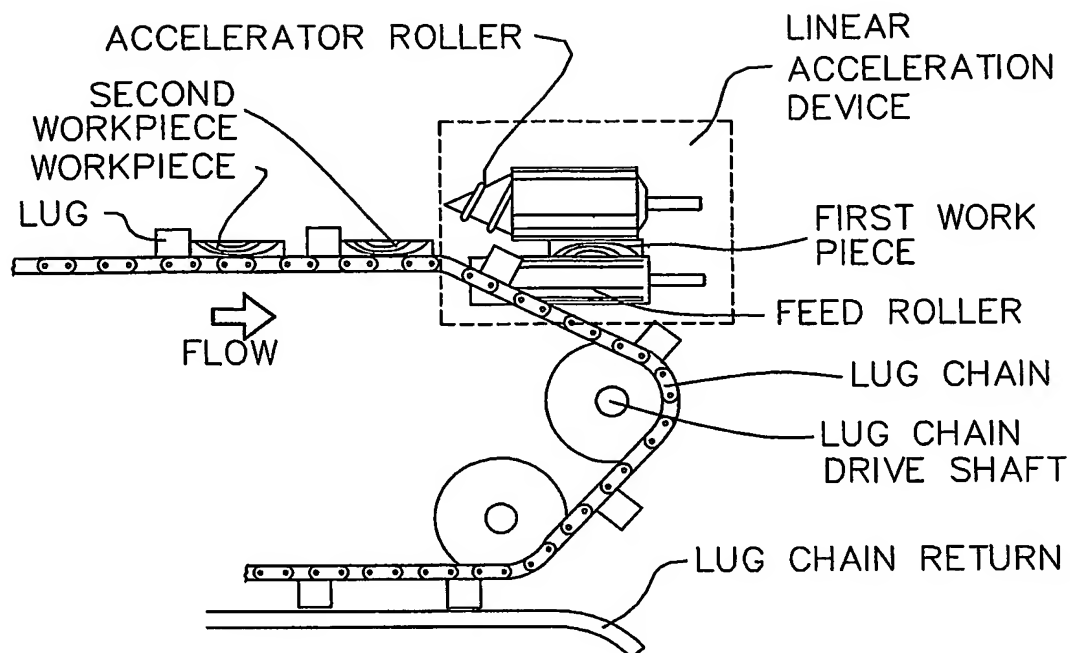
*Fig 9*

LUG TRANSFER DEVICE FEEDING WORKPIECES
ONTO A LINEAR ACCELERATION DEVICE

LUG LOADER
TYPE DEVICE

SHEET OF WORK PIECES

SMOOTH TRANSFER DECK
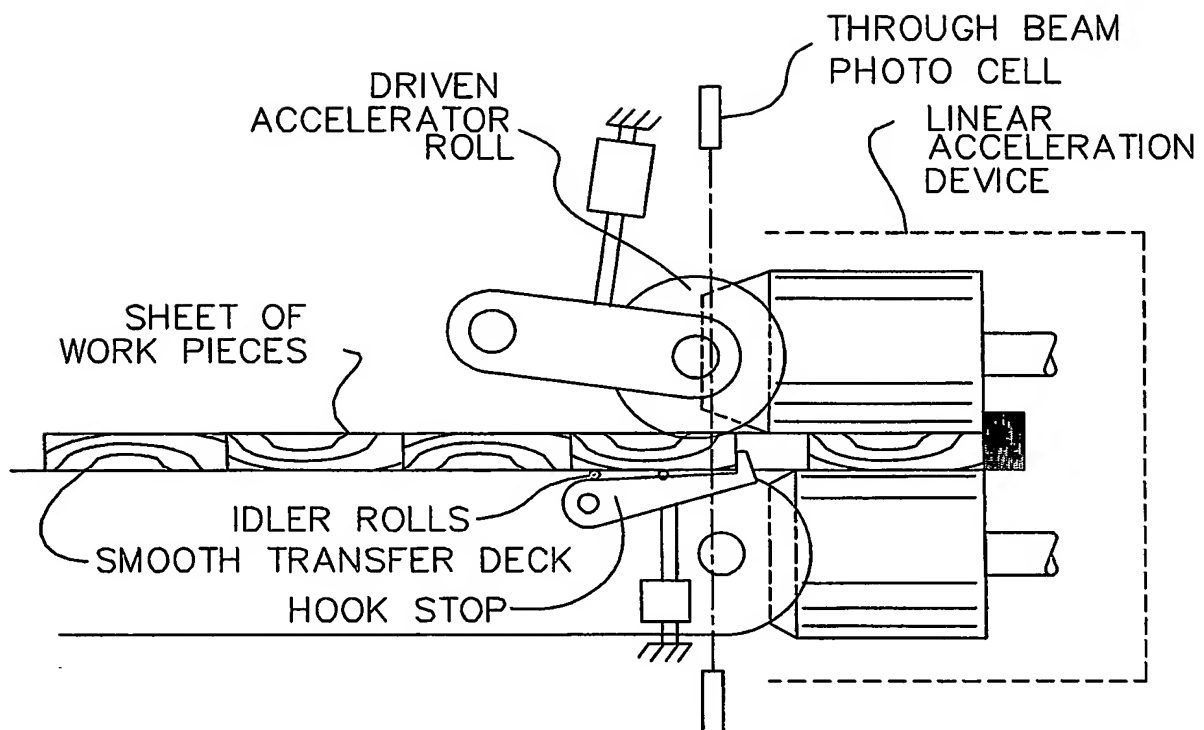
LINEAR
ACCELERATION
DEVICE
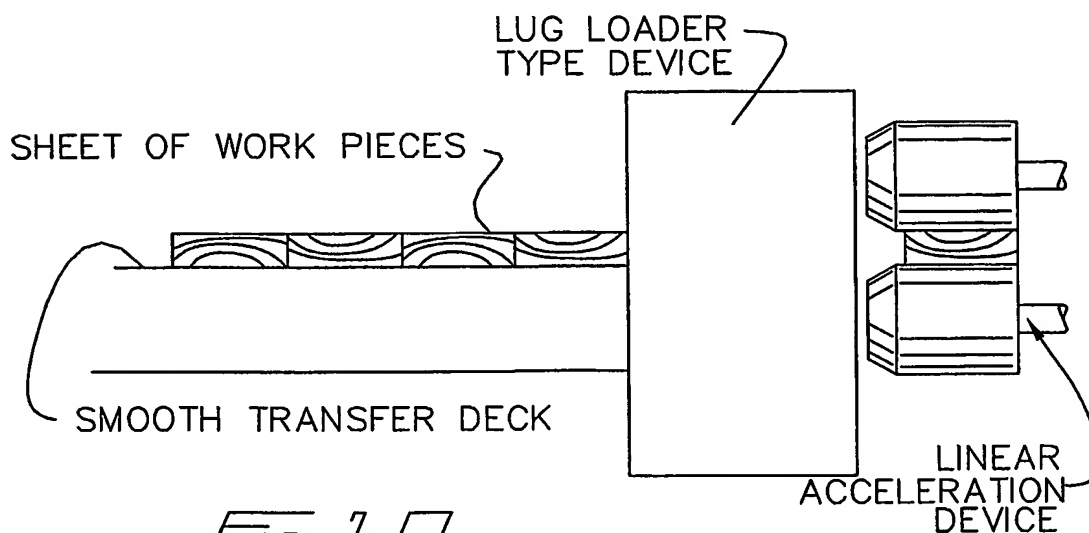
*Fig 10*

LUG LOADER TYPE DEVICE SHEET FEEDER

DRIVEN
ACCELERATOR
ROLL

THROUGH BEAM
PHOTO CELL

LINEAR
ACCELERATION
DEVICE

SHEET OF
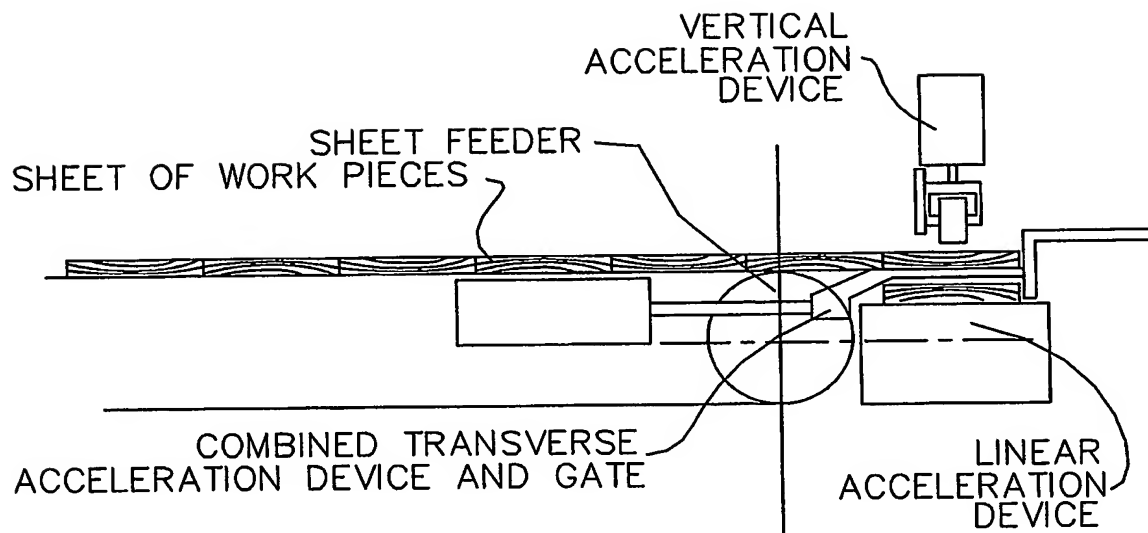WORK PIECES

IDLER ROLLS
SMOOTH TRANSFER DECK
HOOK STOP

*Fig 11*

SHEET FEEDER

*Fig 12*


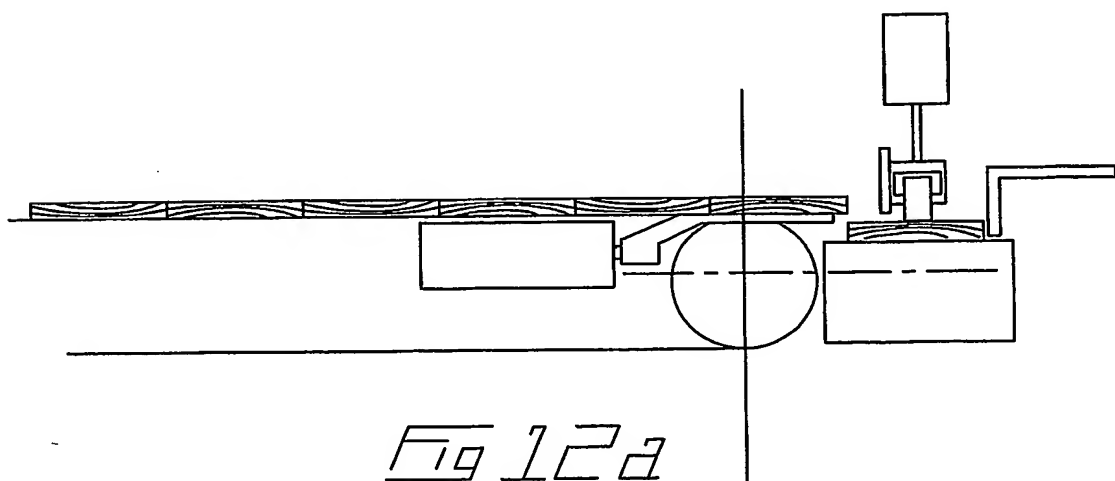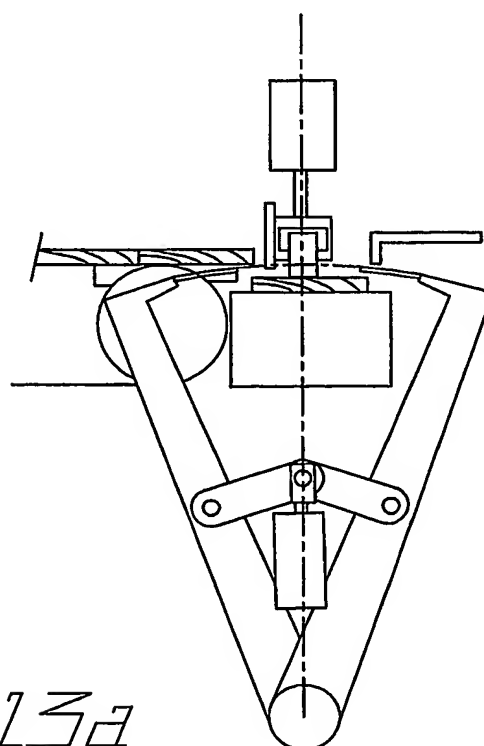
*Fig 12a*

SHEET FED TRANSVERSE ACCELERATION DEVICE COMBINED WITH
VERTICAL ACCELERATION DEVICE AND LINEAR ACCELERATION DEVICE

**11/29**

VERTICAL
ACCELERATION
DEVICE

SHEET OF WORK PIECES

LINEAR
ACCELERATION
DEVICE

*Fig 13*

*Fig 13a*
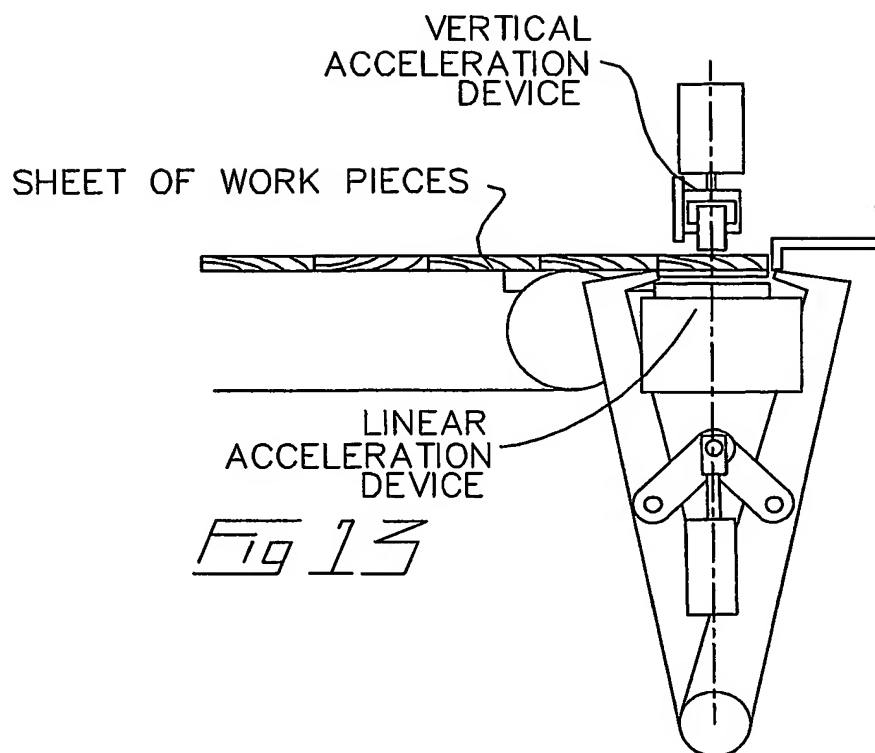
ALTERNATE SHEET FED VERTICAL ACCELERATION

**SUBSTITUTE SHEET (RULE 26)**
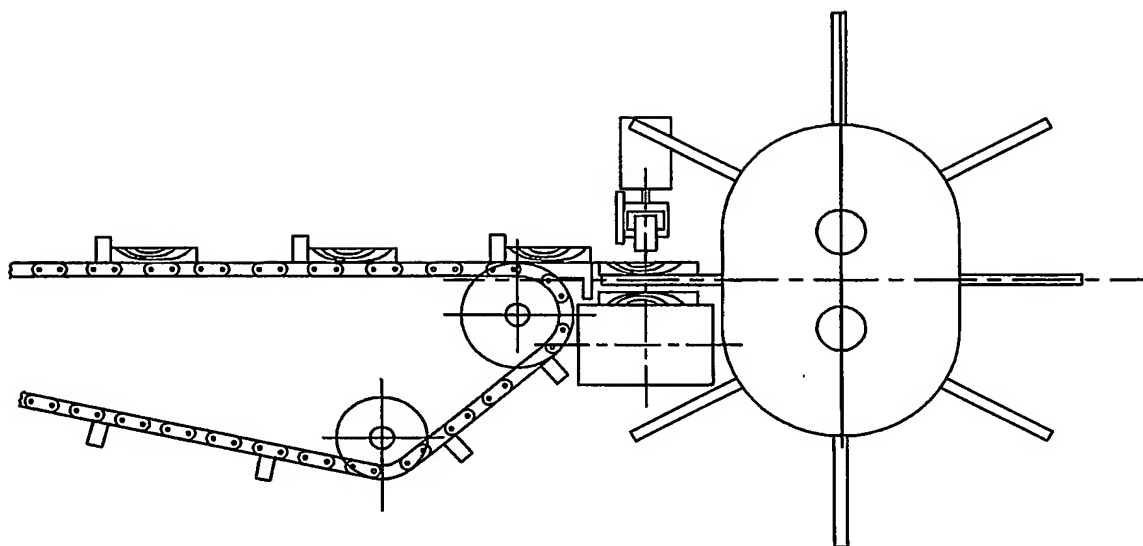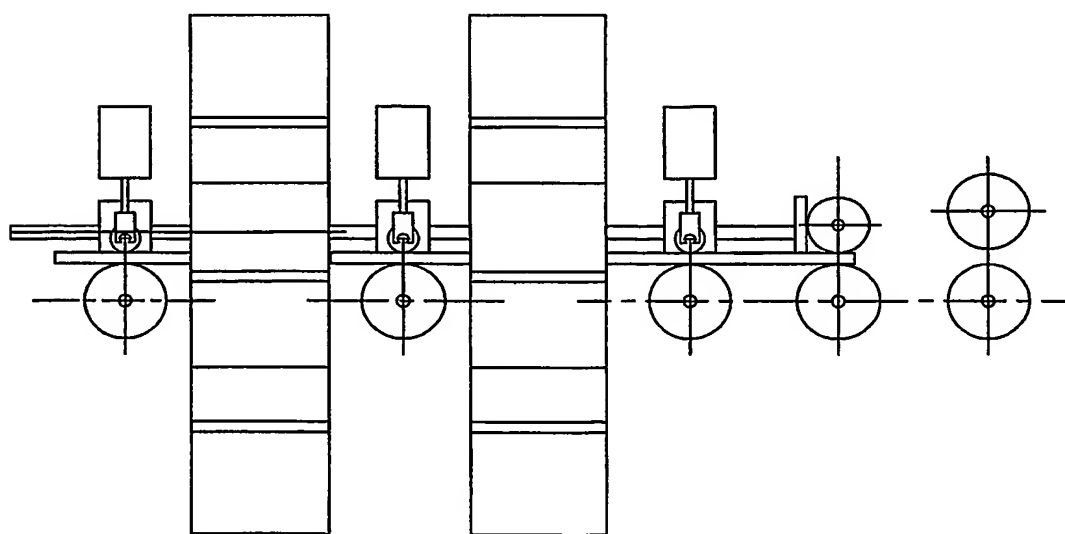
*Fig 14*

*Fig 14a*

CONTINUOUS INDEXIBLE SUPPORT ARM
VERTICAL ACCELERATION DEVICE

VERTICAL ACCELERATION DEVICE

HOPPER FEEDER

SHEET OF
WORK PIECES

*Fig 15a*

LINEAR
ACCELERATION
DEVICE

*Fig 15b*

CATAPULT
ACTUATOR

POWERED
PINCH ROLLERS

*Fig 15c*

*Fig 15d*

SHEET FED HOPPER FEEDER DEVICE

SHEET FEEDER

SHEET OF
WORK PIECES

VERTICAL ACCELERATION
DEVICE

GATE CLOSED

*Fig 16*

LINEAR ACCELERATION
DEVICE

WORK PIECE ON LINEAR
ACCELERATOR

VERTICAL ACCELERATION
DEVICE

FLOW

GATE OPEN
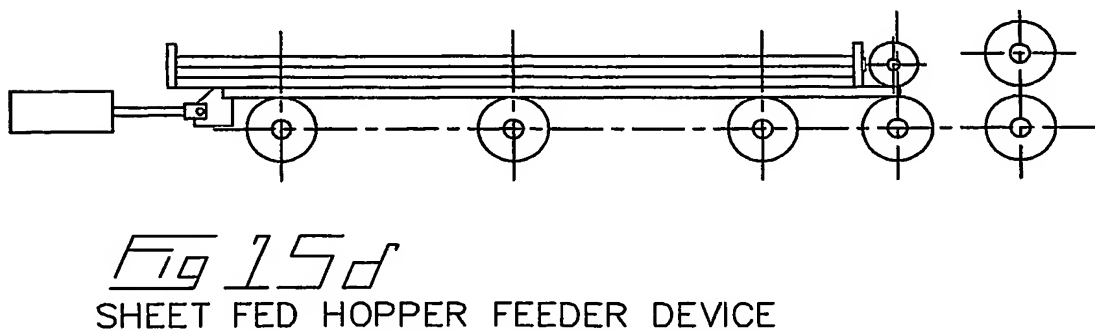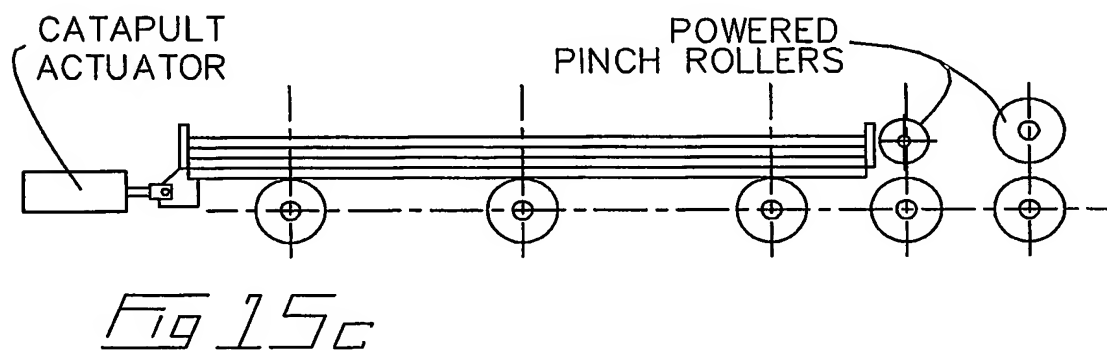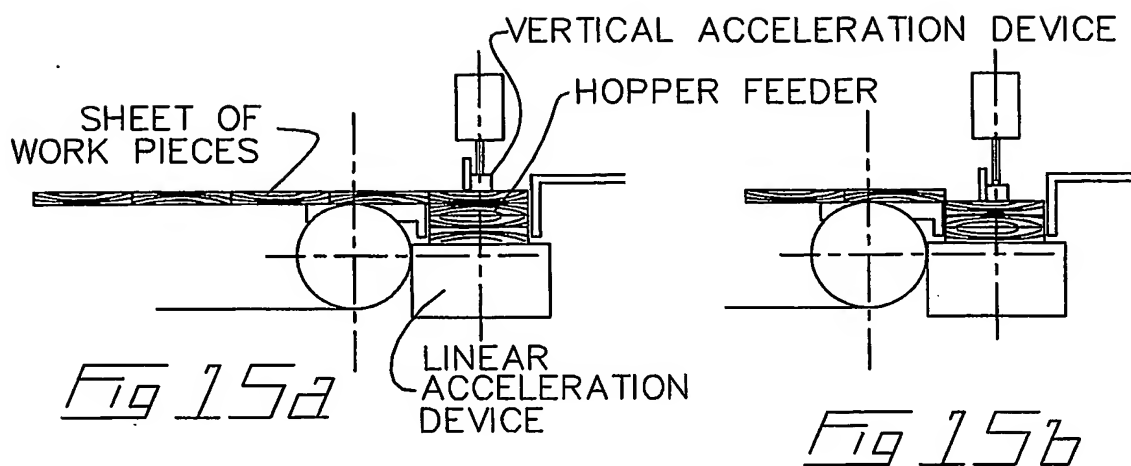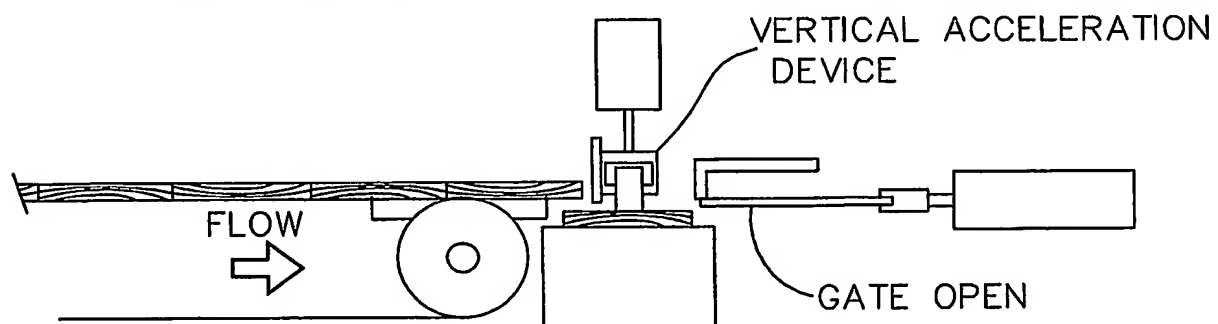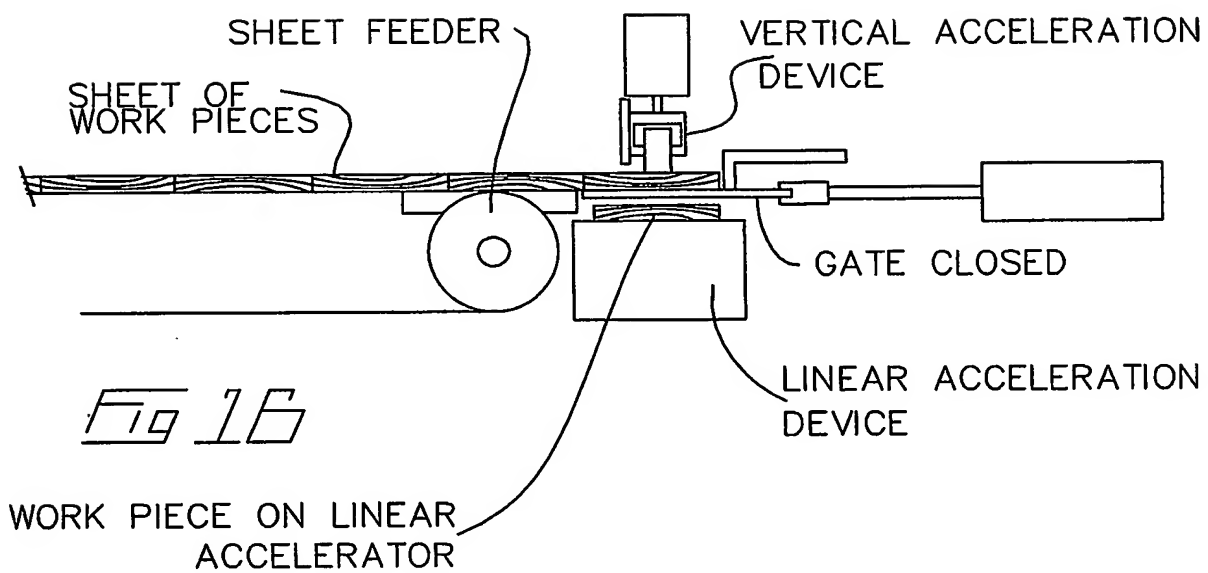
*Fig 16a*

SHEET FED VERTICAL ACCELERATION DEVICE
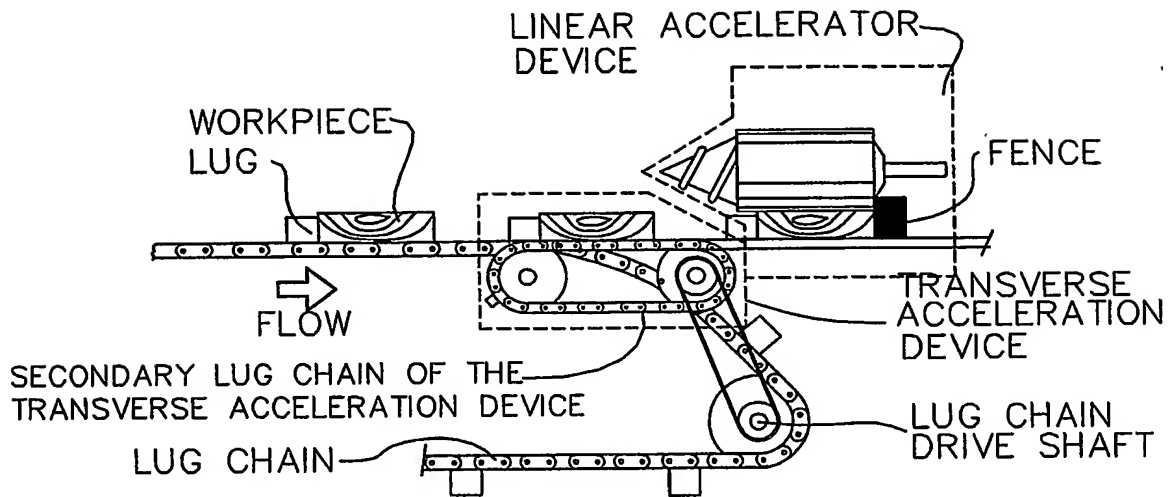
*Fig 17*
TRANSVERSE ACCELERATION DEVICE
FEEDING LINEAR ACCELERATION DEVICE
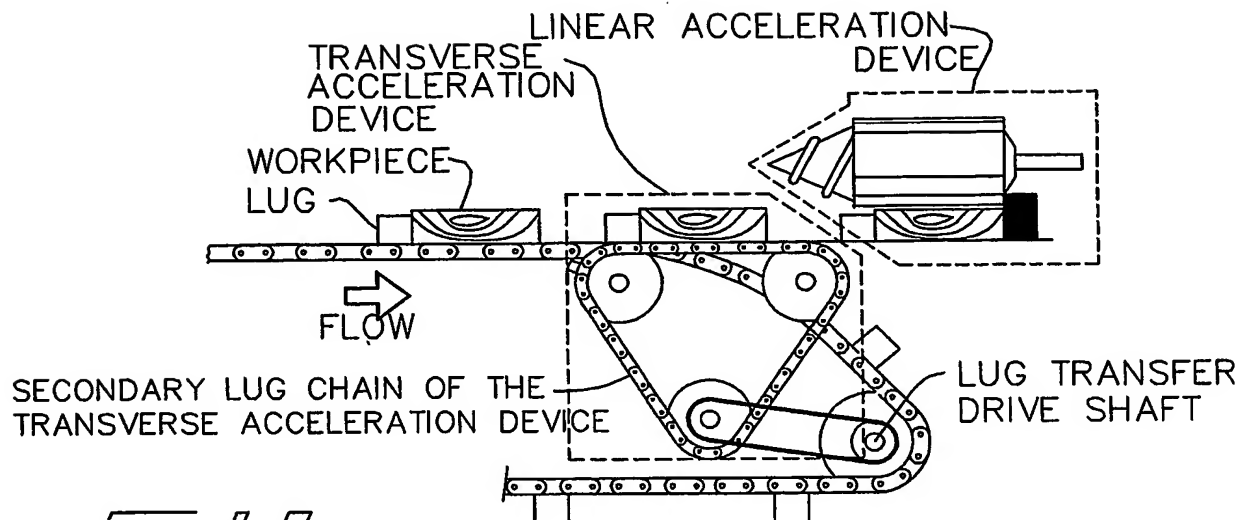
**LINEAR ACCELERATION DEVICE**

**TRANSVERSE ACCELERATION DEVICE**

**WORKPIECE LUG**

**FLOW**

**SECONDARY LUG CHAIN OF THE TRANSVERSE ACCELERATION DEVICE**

**LUG TRANSFER DRIVE SHAFT**

*Fig 18*

**TRANSVERSE ACCELERATION DEVICE FEEDING LINEAR ACCELERATION DEVICE**

**LINEAR ACCELERATION DEVICE**

**HOLD DOWN DEVICE**

**WORKPIECE LUG**

**SECONDARY LUG**

**WHEEL**

**ADJUSTABLE CENTER POINT**

**LUG TRANSFER DRIVE SHAFT**

**CHAIN TAKE UP**
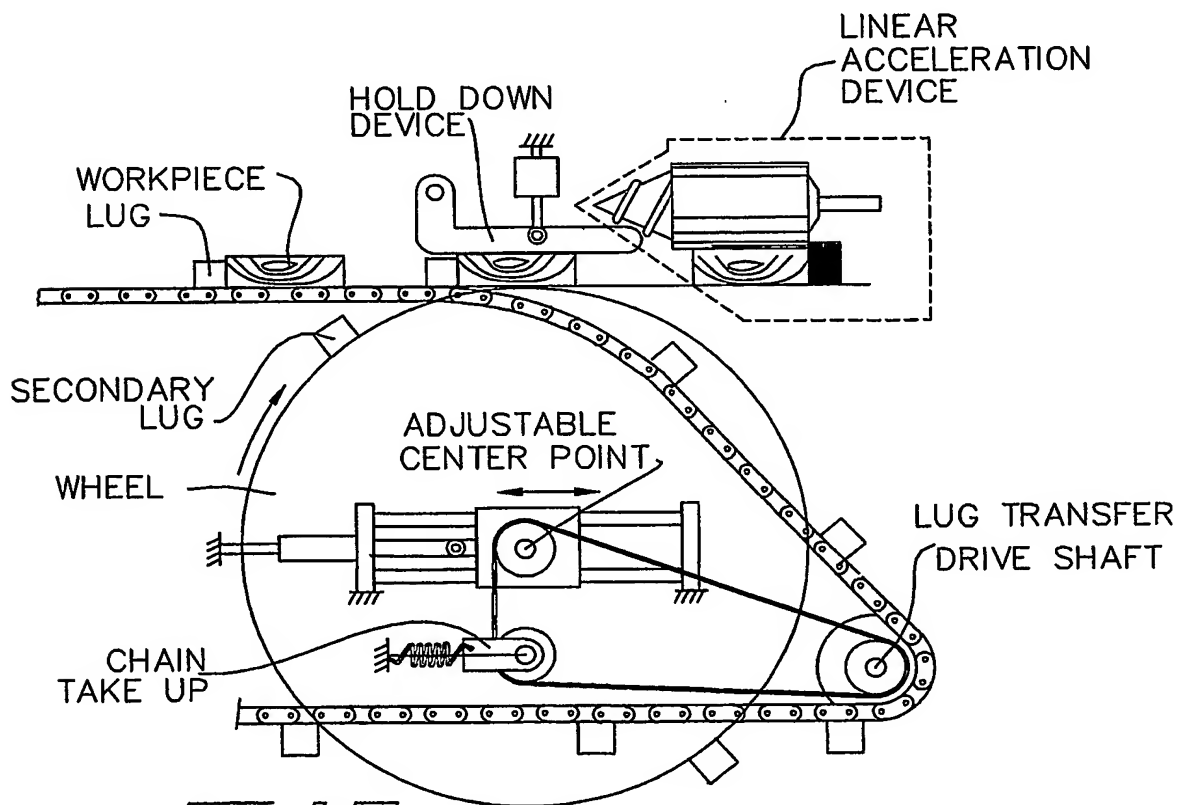
*Fig 19*

**TRANSVERSE ACCELERATION DEVICE ADJUSTABLE WHEEL TYPE**

**SUBSTITUTE SHEET (RULE 26)**

LINEAR ACCELERATION
DEVICE

HOLD DOWN
DEVICE

WORKPIECE
LUG

SECONDARY
LUG

WHEEL

LUG TRANSFER
DRIVE SHAFT
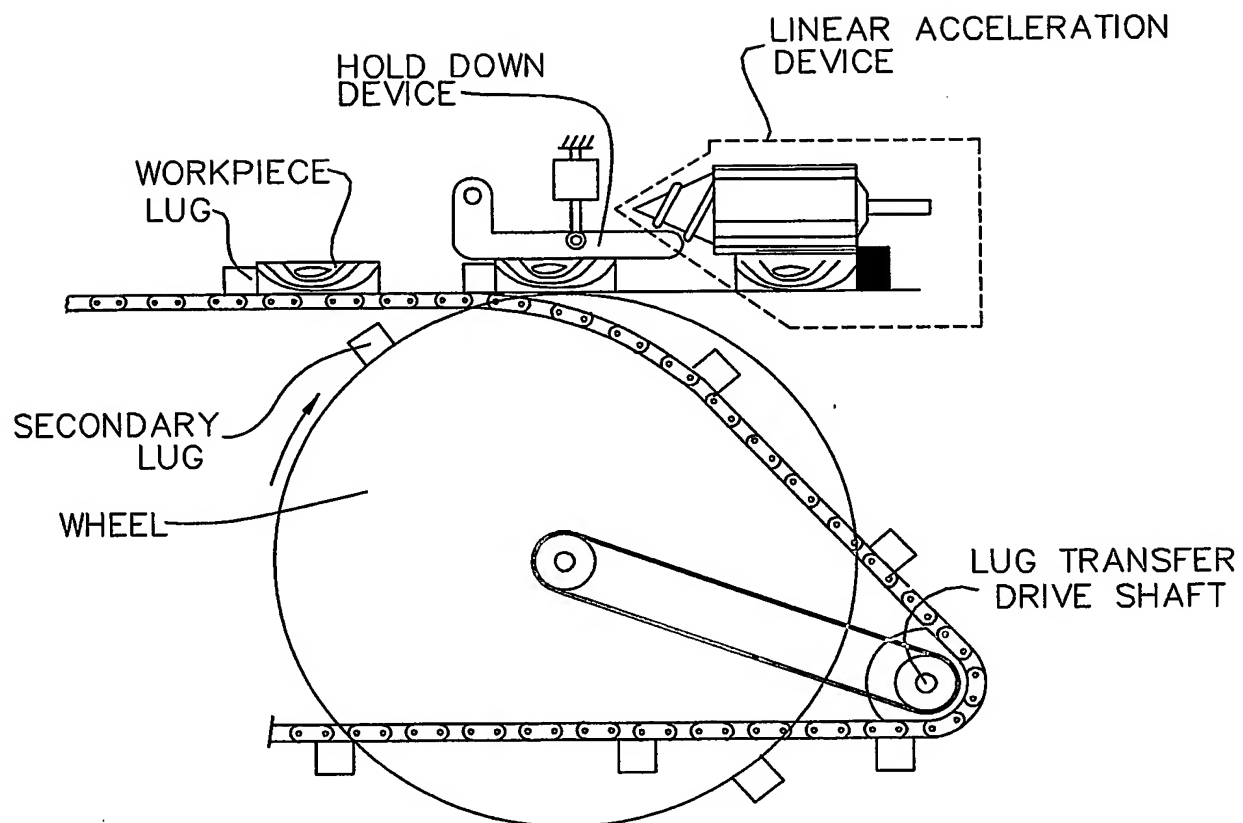
*Fig 20*

TRANSVERSE ACCELERATION DEVICE

**18/29**

HINGED LUG

LINEAR ACCELERATION DEVICE

WORK PIECE
LUG

FENCE

HINGE POINT

FINISH POSITION

BELL CRANK
ARM

CRANK SHAFT

LUG
TRANSFER
DRIVE SHAFT

CONNECTING
ROD
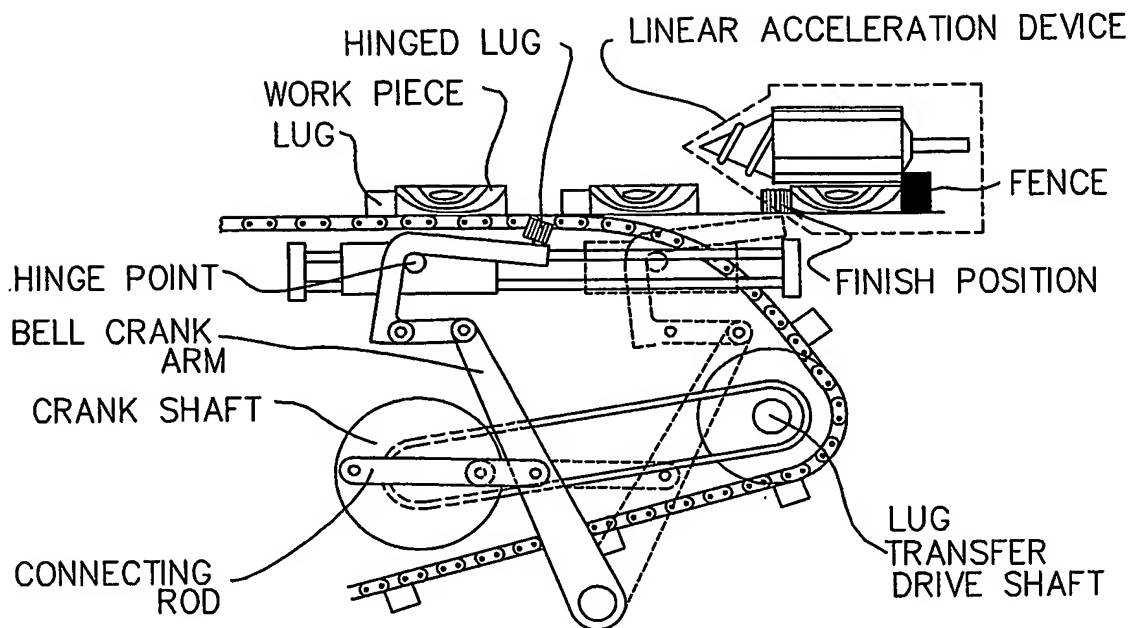
*Fig 21*

TRANSVERSE ACCELERATION DEVICE
SLIDER CRANK TYPE

HINGED LUG

LINEAR ACCELERATOR DEVICE

WORK PIECE
LUG

HINGE POINT

FINISH POSITION

BIAS ACTUATOR

CONNECTING
ROD

CRANK SHAFT

LUG TRANSFER
DRIVE SHAFT
BELL CRANK
ARM
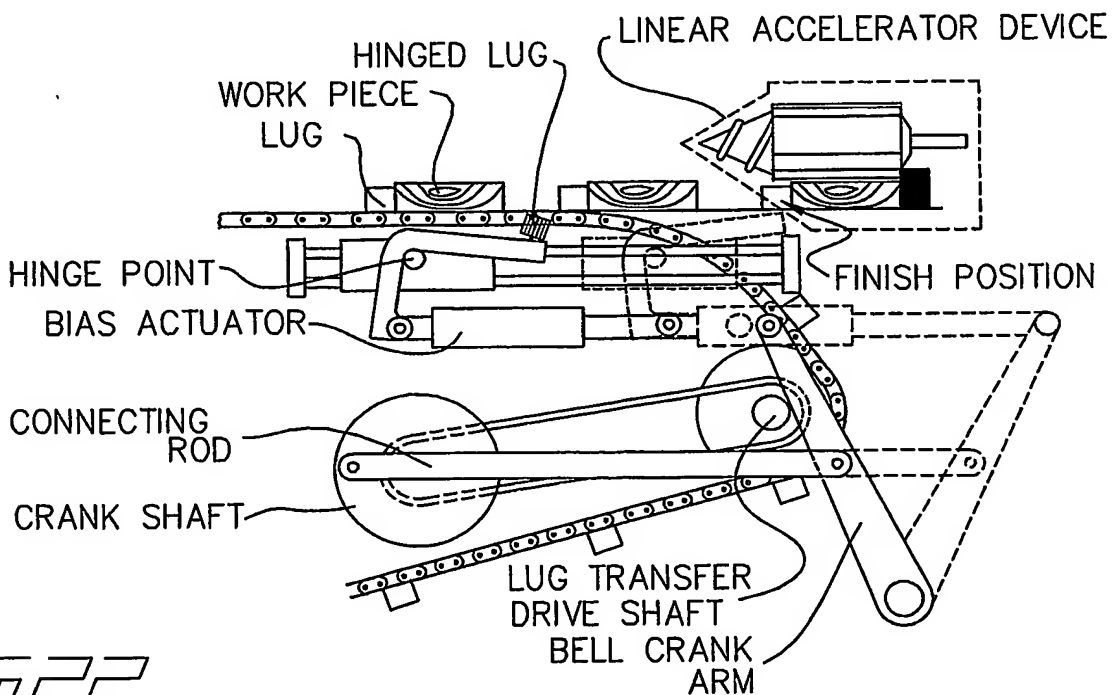
*Fig 22*

TRANSVERSE ACCELERATION DEVICE WITH
ADJUSTABLE START STOP POINTS

**SUBSTITUTE SHEET (RULE 26)**

Fig 23

EXAMPLE OF FULLY OPTIMIZED GAP CONTROL
(WITH AND WITHOUT THE ADDITION OF TRIM DECISION GAP OPTIMIZATION)

20/29

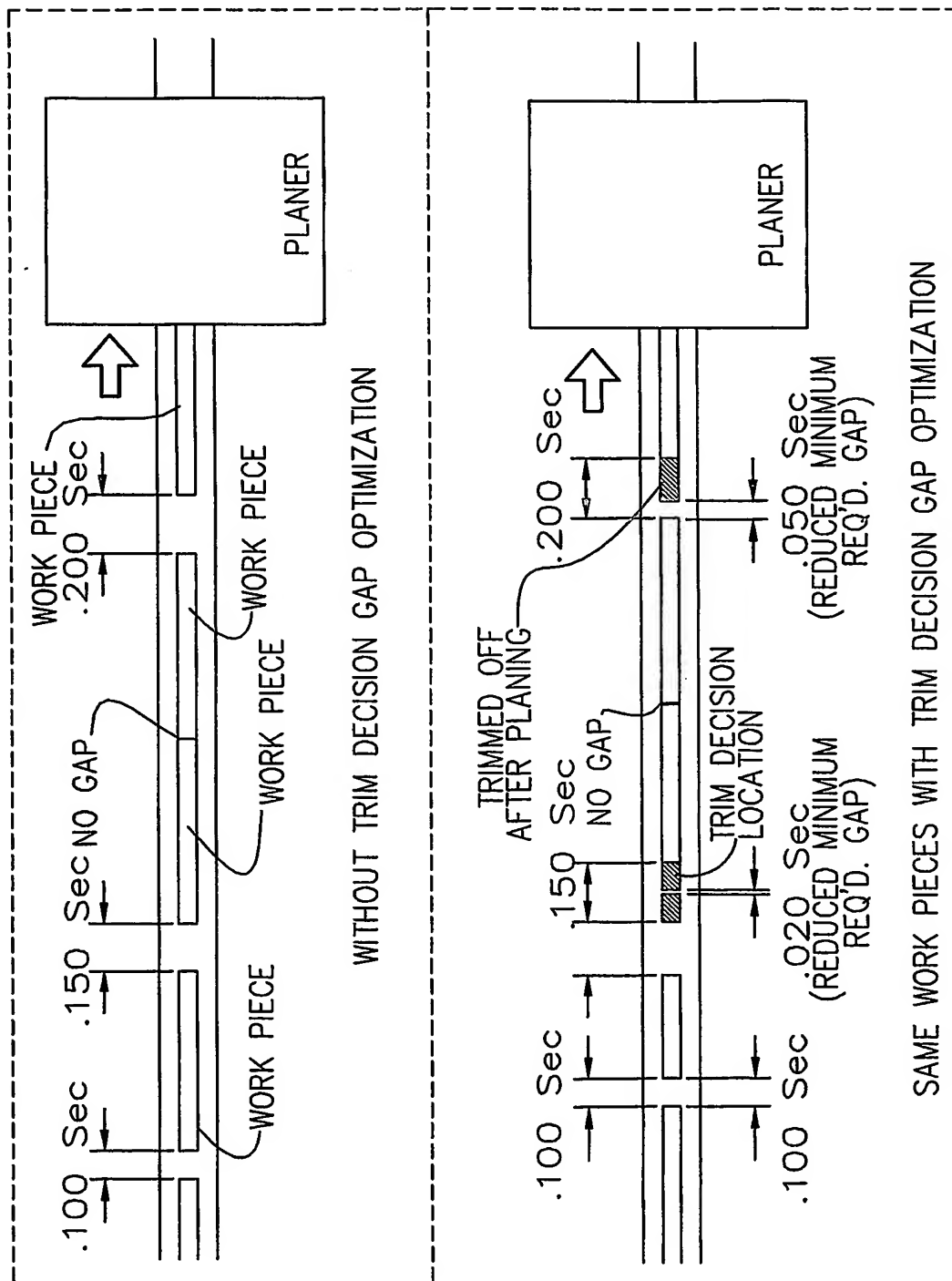| | SHEET FEEDER | FIXED SPEED LUG TRANSFER | VARIABLE SPEED LUG TRANSFER | FIXED SPEED TAD | VARIABLE SPEED TAD | VERTICAL AD | FIXED SPEED LAD | VARIABLE SPEED LAD | FIXED SPEED ITD | VARIABLE SPEED ITD | FIXED SPEED PLANER | VARIABLE SPEED PLANER | LINEAR WPI | TRANSVERSE WPI | WPS | OLNO | CLNO | CLO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R |
| 1 | X | | | | | | X | | X | | X | | X | | | X | | |
| 2 | X | | | | | | X | | | X | X | | X | | X | | X | |
| 3 | X | | | | | | X | | | X | X | | X | | X | | | X |
| 4 | X | | | | | | X | | | X | | X | X | | X | | X | |
| 5 | X | | | | | | X | | | X | | X | X | | X | | | X |
| 6 | X | | | | | | | X | X | | X | | X | | X | | X | |
| 7 | X | | | | | | | X | X | | X | | X | | X | | | X |
| 8 | X | | | | | | | X | X | | | X | X | | X | | X | |
| 9 | X | | | | | | | X | X | | | X | X | | X | | | X |
| 10 | X | | | | | | | X | | X | X | | X | | X | | X | |
| 11 | X | | | | | | | X | | X | X | | X | | X | | | X |
| 12 | X | | | | | | | X | | X | | X | X | | X | | X | |
| 13 | X | | | | | | | X | | X | | X | X | | X | | | X |
| 14 | X | | | | | X | X | | X | | X | | X | | | X | | |
| 15 | X | | | | | X | X | | | X | X | | X | | X | | X | |
| 16 | X | | | | | X | X | | | X | X | | X | | X | | | X |
| 17 | X | | | | | X | X | | | X | | X | X | | X | | X | |
| 18 | X | | | | | X | X | | | X | | X | X | | X | | | X |
| 19 | X | | | | | X | | X | X | | X | | X | | X | | X | |
| 20 | X | | | | | X | | X | X | | X | | X | | X | | | X |
| 21 | X | | | | | X | | X | | X | X | | X | | X | | X | |
| 22 | X | | | | | X | | X | | X | X | | X | | X | | | X |
| 23 | X | X | | | | | X | | X | | X | | | X | | X | | |
| 24 | X | X | | | | | X | | | X | X | | | X | X | | X | |
| 25 | X | X | | | | | X | | | X | X | X | | X | X | | X | |
| 26 | X | X | | | | | X | | | X | | X | | X | X | | X | |
| 27 | X | X | | | | | X | | | X | | X | | X | X | | X | |
| 28 | | X | | | | | X | | | | X | | | X | X | | | |
| 29 | | X | | | | | X | | X | | X | | | X | X | | | |
| 30 | | X | | X | | | X | | X | | X | | | X | X | | | |
| 31 | | X | | X | | | X | | | | X | | | X | X | | | |
| 32 | | X | | | | | X | | | X | X | | | X | X | | X | |
| 33 | | X | | X | | | X | | | X | X | | | X | X | | X | |
| 34 | | | X | | | | X | | | | X | | | X | X | | X | |
| 35 | | | X | | | | X | | | | X | | | X | X | | | X |
| 36 | | | X | X | | | X | | | | X | | | X | X | | X | |
| 37 | | | X | X | | | X | | | | X | | | X | X | | | X |
| 38 | | | X | | X | | X | | | | X | | | X | X | | X | |
| 39 | | | X | | X | | X | | | | X | | | X | X | | | X |
| 40 | | | X | | | | | X | | | X | | | X | X | | X | |
| 41 | | | X | | | | | X | | | X | | | X | X | | | X |
| 42 | | | X | | | | X | | | X | X | | | X | X | | X | |
| 43 | | | X | | | | X | | | X | X | | | X | X | | | X |
| 44 | | | X | | | | X | | | X | X | | | X | X | | X | |

*Fig 24*

CONTINUATION OF

*Fig 24*

| | A SHEET FEEDER | B FIXED SPEED LUG TRANSFER | C VARIABLE SPEED LUG TRANSFER | D FIXED SPEED TAD | E VARIABLE SPEED TAD | F VERTICAL AD | G FIXED SPEED LAD | H VARIABLE SPEED LAD | I FIXED SPEED ITD | J VARIABLE SPEED ITD | K FIXED SPEED PLANER | L VARIABLE SPEED PLANER | M LINEAR WPI | N TRANSVERSE WPI | O WPS | P OLNO | Q CLNO | R CLO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 45 | | | X | | | | X | | | X | | X | | X | X | | | X |
| 46 | | | X | X | | | | X | X | | X | | | X | X | | X | |
| 47 | | | X | X | | | | X | X | | X | | | X | X | | | X |
| 48 | | | X | X | | | | X | | X | X | | | X | X | | X | |
| 49 | | | X | X | | | | X | | X | X | | | X | X | | | X |
| 50 | | | X | X | | | | X | | X | | X | | X | X | | X | |
| 51 | | | X | X | | | | X | | X | | X | | X | X | | | X |
| 52 | | | X | | X | | X | | X | | X | | | X | X | | X | |
| 53 | | | X | | X | | X | | X | | X | | | X | X | | | X |
| 54 | | | X | | X | | | X | X | | X | | | X | X | | X | |
| 55 | | | X | | X | | | X | X | | X | | | X | X | | | X |
| 56 | | | X | | X | | | X | | X | X | | | X | X | | X | X |
| 57 | | | X | | X | | | X | | X | X | | | X | X | | | X |
| 58 | | | X | | X | | | X | | X | | X | | X | X | | X | |
| 59 | | | X | | X | | | X | | X | | X | | X | X | | | X |
| 60 | | X | | | | X | X | | | | X | | | X | | X | | |
| 61 | | X | | | | X | X | | X | | X | | | X | | X | | |
| 62 | | X | | | | X | X | | | X | X | | | X | X | | X | |
| 63 | | X | | | | X | | X | | X | X | | | X | X | | X | |
| 64 | | X | | | | X | | X | | X | X | | | X | X | | | X |
| 65 | | X | | | | X | | X | | X | | X | | X | X | | X | |
| 66 | | X | | | | X | | X | | X | | X | | X | X | | | X |
| 67 | | | X | | | X | X | | | | X | | | X | X | | X | |
| 68 | | | X | | | X | X | | | | X | | | X | X | | | X |
| 69 | | | X | | | X | X | | X | | X | | | X | X | | X | |
| 70 | | | X | | | X | X | | X | | X | | | X | X | | | X |
| 71 | | | X | | | X | | X | X | | X | | | X | X | | X | |
| 72 | | | X | | | X | | X | X | | X | | | X | X | | | X |
| 73 | | | X | | | X | | X | | X | X | | | X | X | | X | |
| 74 | | | X | | | X | | X | | X | X | | | X | X | | | X |
| 75 | | | X | | | X | | X | | X | | X | | X | X | | X | |
| 76 | | | X | | | X | | X | | X | | X | | X | X | | | X |
| 77 | | | X | | | X | X | | | X | | X | | X | X | | X | |
| 78 | | | X | | | X | X | | | X | | X | | X | X | | | X |
| 79 | | | X | | | X | | | X | | | X | | X | X | | X | |
| 80 | | | X | | | X | | | X | | | X | | X | X | | | X |
| 81 | | | X | | | X | X | | | X | X | | | X | X | | X | |
| 82 | | | X | | | X | X | | | X | X | | | X | X | | | X |
| 83 | | | X | X | | | X | | X | | X | | X | X | | | X | |
| 84 | | | X | X | | | X | | | X | X | | X | X | | | | X |
| 85 | | | X | X | | | X | | | X | X | | X | X | | | X | |
| 86 | | | X | | X | | X | | | X | X | | X | X | | | X | |
| 87 | | | X | | X | | X | | | X | X | | X | X | | | | X |
| 88 | | | X | | X | | | | X | | X | | X | X | | | | X |

**SUBSTITUTE SHEET (RULE 26)**

LUMBER TILT HOIST

SMOOTH TOP CHAIN WAY

SHEET FEEDER

LINEAR ACCELERATION DEVICE

TRANSVERSE ACCELERATION DEVICE

PLANER INFEED TRANSPORT DEVICE

PLANER

CONVENTIONAL PLANER INFEED SYSTEM–SHORT INFEED TRANSPORT DEVICE
(BEFORE CONVERSION TO OPTIMIZED SYSTEM)

SHORT INFEED TRANSPORT DEVICE

*Fig 25*

CONTROL
SYSTEM

LUMBER TILT HOIST

SMOOTH TOP CHAIN WAY

LUG LOADER

LUG TRANSFER DEVICE

TRANSVERSE WORK PIECE INTERROGATOR

SHEET FEEDER

PLANER

LINEAR ACCELERATION DEVICE

WORK PIECE SENSING ZONE

TRANSVERSE ACCELERATION DEVICE

PLANER INFEED TRANSPORT DEVICE

VARIABLE SPEED DRIVES

PLANER INFEED SYSTEM-SHORT INFEED TRANSPORT DEVICE

*Fig 26*

CONVENTIONAL PLANER INFEED SYSTEM-SHORT INFEED TRANSPORT DEVICE
(AFTER CONVERSION TO OPTIMIZED SYSTEM)

LUMBER TILT HOIST

SMOOTH TOP CHAIN WAY

SHEET FEEDER

PLANER

LINEAR ACCELERATION DEVICE

TRANSVERSE ACCELERATION DEVICE

PLANER INFEED TRANSPORT DEVICE

*Fig 7*

CONVENTIONAL PLANER INFEED SYSTEM–LONG INFEED TRANSPORT DEVICE
(BEFORE CONVERSION TO OPTIMIZED SYSTEM)

LUMBER TILT HOIST

SMOOTH TOP CHAIN WAY

CONTROL SYSTEM

OPTIMIZED PLANER

LINEAR WORK PIECE INTERROGATION DEVICE

SHEET FEEDER

WORK PIECE SENSING ZONE

LINEAR ACCELERATION DEVICE

TRANSVERSE ACCELERATION DEVICE

PLANER INFEED TRANSPORT DEVICE

VARIABLE SPEED DRIVES

*Fig 28*

CONVENTIONAL PLANER INFEED SYSTEM—LONG INFEED TRANSPORT DEVICE
AFTER CONVERSION TO OPTIMIZED SYSTEM)

OPTIMIZED

PLANER

DEFECTIVE SIDE

PLANER INFEED
TRANSPORT DEVICE

INTENDED SIDE PROFILES OF
FINISHED WORK PIECE

125 ms

135ms

INDIVIDUAL WORK PIECE

Ⓐ

Ⓑ

Ⓒ

DEFECTIVE SIDE

*Fig 29*
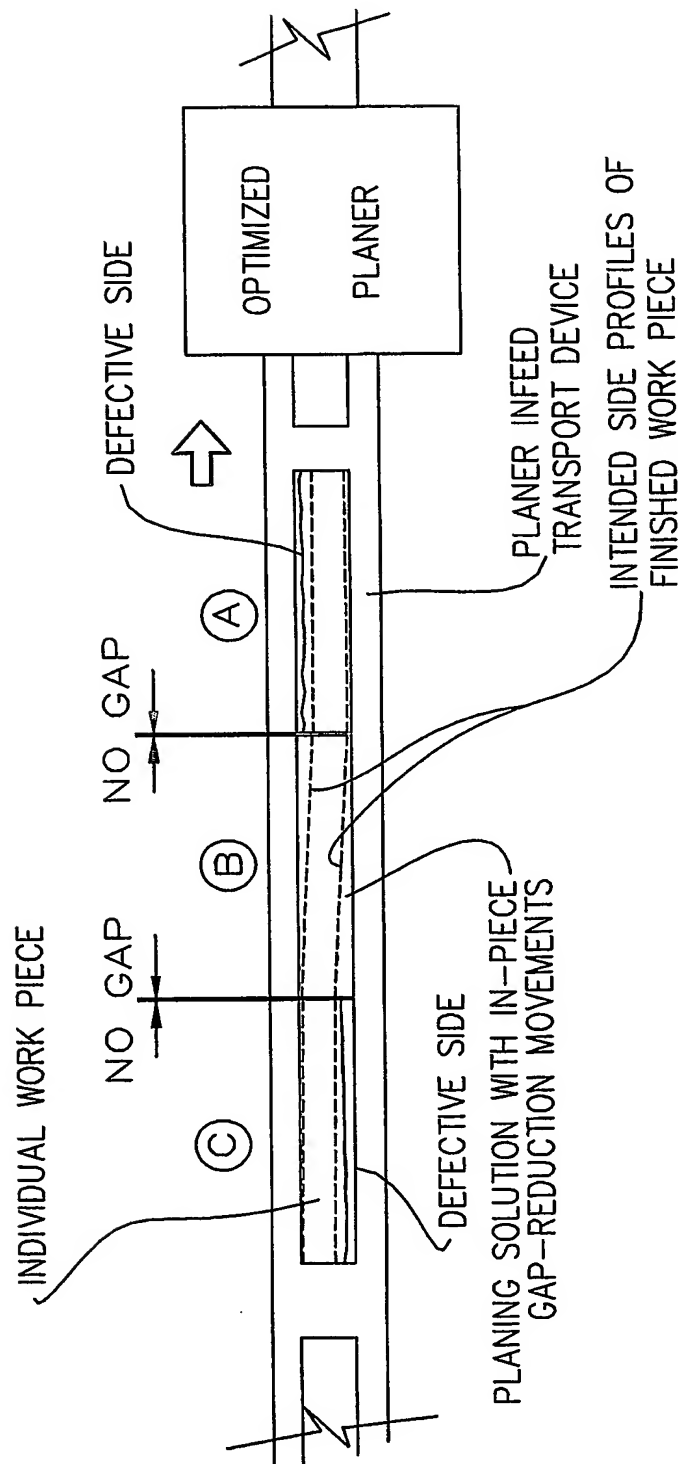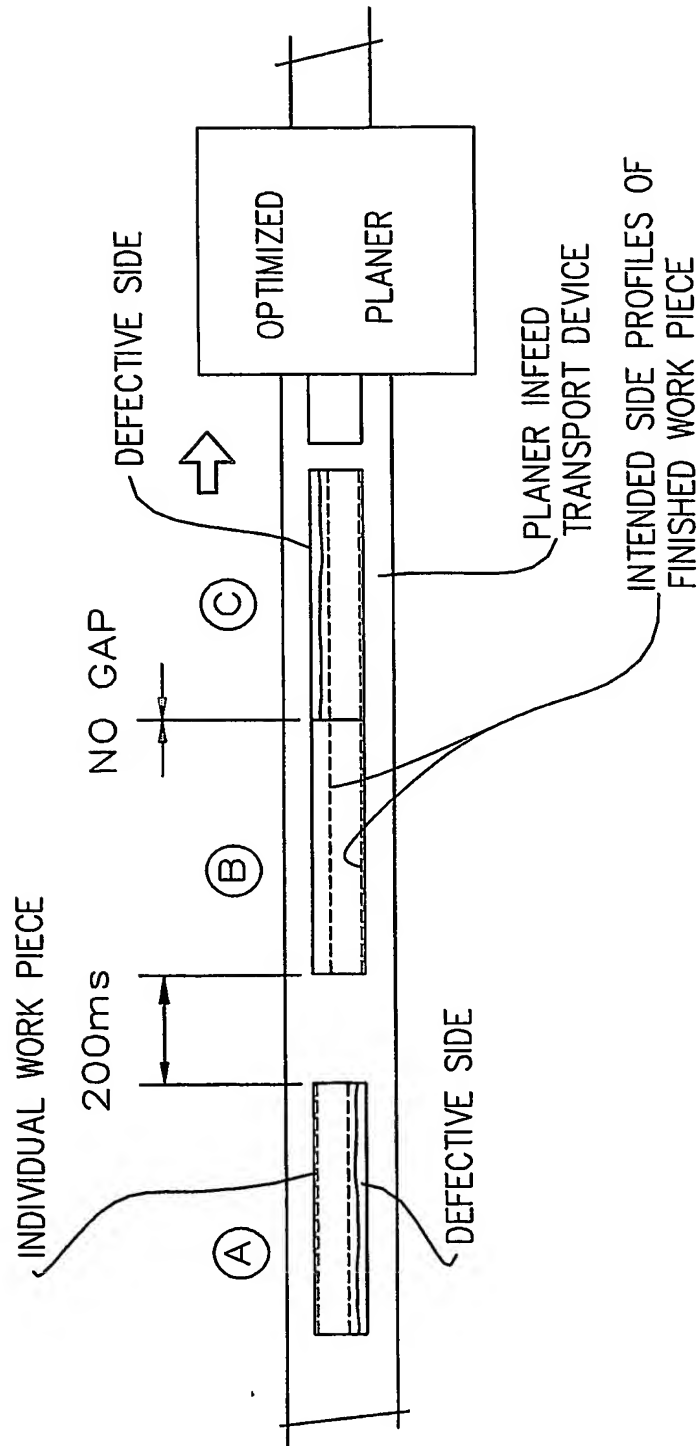
OPTIMIZED GAPPING (WITHOUT IN–PIECE GAP–REDUCTION MOVEMENTS)

Fig 30

OPTIMIZED GAPPING (WITH IN-PIECE GAP-REDUCTION MOVEMENTS)

*Fig 31*
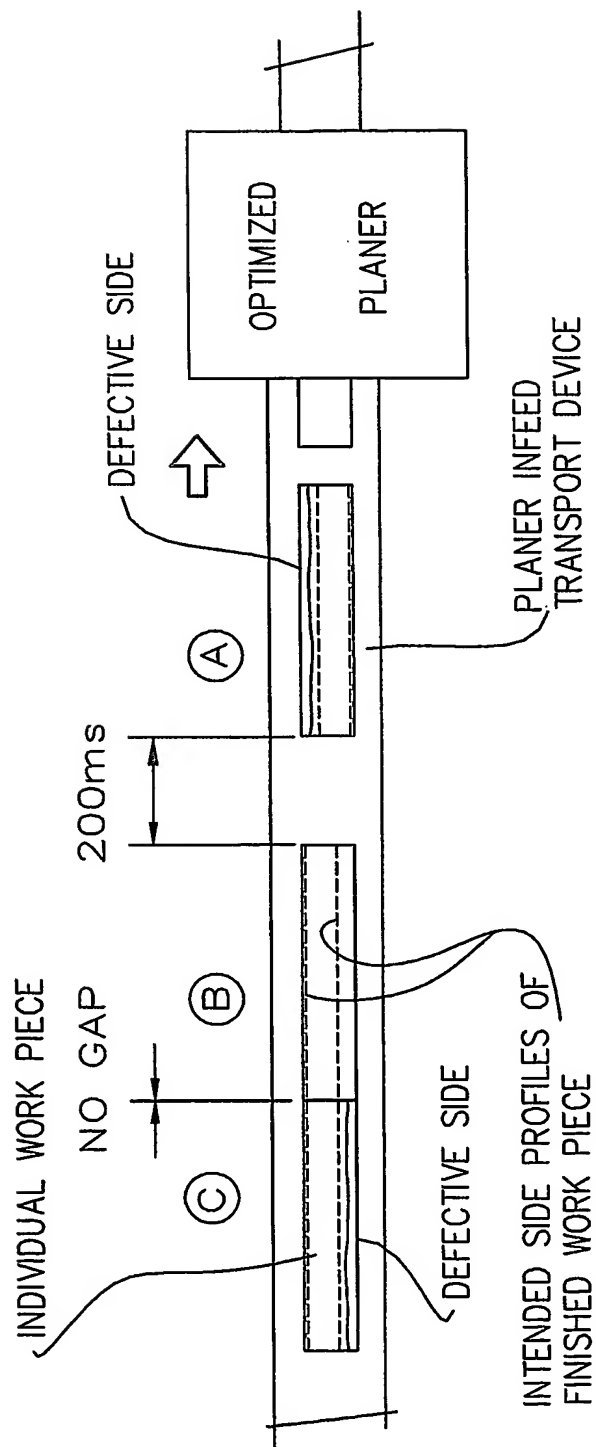
OPTIMIZED GAPPING (WITHOUT IN-PIECE GAP-REDUCTION MOVEMENTS)

*Fig 32*

OPTIMIZED GAPPING (WITHOUT IN-PIECE GAP-REDUCTION MOVEMENTS)